DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to films obtained by the method of manufacturing films, such as a metal conducting film which can mainly be used for wiring and a terminal, and this method, such as a metallic colloid conducting film which has the outstanding conductivity, in detail about the membranous manufacturing method and the film obtained by this from the liquid phase.

[0002]

[Description of the Prior Art]Before, as a method of forming various functional membrane (thin films, such as a conducting film and an insulator layer) in electron devices, such as a semiconductor device, a vacuum process, for example, a vacuum deposition method, a chemical-vapor-deposition method (CVD) method, sputtering, etc. are adopted. Since a device enlarged them since these processes need to form a vacuum, and it became complicated in many cases, the simpler and highly efficient thin-film-forming process was demanded.

[0003]The place made into the technical problem of this invention is providing the method of manufacturing the film (thin film) of the good characteristic by the simple device and a method.

[0004]

[Means for Solving the Problem]This invention forms a colloid layer on a substrate, and provides a manufacturing method of a film irradiating the surface of this colloid layer with an energy line which serves as big absorption intensity by this colloid layer from this substrate.

[0005]By performing specific processing to especially metallic colloid, this invention person used to remove an organic matter which exists in the circumference of metallic colloid from the first, used to form metal-metallic contacts, and used to do the knowledge of the ability to solve said technical problem.

[0006]

[Embodiment of the Invention](Membranous manufacturing method) The manufacturing method of the film of this invention is explained in detail hereafter. The manufacturing method of the film of this invention forms a colloid layer on a substrate, and irradiates the surface of this colloid layer with the energy line which serves as big absorption intensity by this colloid layer from this substrate. This invention is based on neither a large-sized device nor a complicated method, but makes it possible to obtain the film of the good characteristic by a method simple in this way. And especially in this invention, the conducting film excellent in conductivity can be cheaply obtained by providing a metallic colloid layer on a substrate and performing the above-mentioned specific processing.

[0007]Hereafter, the example of the manufacturing method of the conducting film using the above-mentioned metallic colloid is explained in full detail as a desirable embodiment of the manufacturing method of the film of this invention. As metallic colloid is generally shown in drawing 1 for stabilization of colloid, the organic matter 3 has adhered to the circumference of the metal 1. Here, as an example of the organic matter 3, citrate, PVP (N-vinyl-2-pyrrolidone), a MMS-NVP (mercaptomethylstyrene N-vinyl-2-pyrrolidone) copolymer, polyacrylonitrile, etc. are mentioned.

[0008]In this embodiment, in order to usually form a metallic colloid layer from the liquid phase on a substrate, as shown in drawing 2 (a), the metallic colloid layer 2 (before unsettledness, i.e., the energy-line exposure mentioned later) is in the state where the metal (colloid) 1 distributed to the organic matter

(layer) 3, on the substrate 4. And only the organic matter 3 in the metallic colloid layer 2 is removed by the exposure of said energy line concerning this invention, and contact strong between the metal 1 can be formed after an exposure (refer to drawing 2 (b)). For this reason, it has the outstanding effect that the conducting film 10 with high conductivity is obtained. In this embodiment, since the organic matter by the exposure of said energy line can be removed in an instant and the wavelength of said energy line can be chosen to some extent, a desired conducting film can be formed, without affecting a substrate.

[0009]Although the energy line in particular used as big absorption intensity is not restricted in a metallic colloid layer from the substrate used for this embodiment, a near ultraviolet ray, visible light, a near infrared line, infrared rays, far-infrared rays, etc. are mentioned, for example. And in order to irradiate the surface of a metallic colloid layer with such an energy line, it can carry out by using a device, a lamp [high power / region / near-infrared / it is desirable and visible and], etc. which emit this energy line.

[0010]Said energy line serves as big absorption intensity in a metallic colloid layer, it is especially more preferred than a substrate that the ratio to the absorption intensity of the substrate of the absorption intensity of a metallic colloid layer is 2-infinity (the absorption intensity of a substrate is 0), and it is still more preferred that it is 100-infinity. If it is in the range of such an absorption intensity ratio, since a metallic colloid layer can mainly absorb irradiation energy and the damage by the heat of a substrate can be prevented, it is desirable.

[0011]As a device which emits said energy line, what equipped a xenon lamp, a halogen lamp, a mercury-vapor lamp, or each lamp with the filter is mentioned, for example, and especially a xenon lamp (the example is shown in drawing 3) is preferred.

[0012]The dose to the surface of the metallic colloid layer of said energy line, although it will not be restricted especially if it is the quantity which may reveal the effect of this invention -- 100 -- it is preferred to use the energy-line radiation device of 400-600W preferably, and to carry out W-1 kW for 10 to 600 seconds in the quantity with which it irradiates for 50 to 200 seconds preferably. When irradiating with said energy line, it may be made to become whole surface light, but it is preferred to make it become focal light.

[0013]The metal which can form a metallic colloid layer in order to form a metallic colloid layer on a substrate, And it is preferred for it to be carried out by the spin coat method, the forming-membranes method using the head for ink jet recording, the forming-membranes method by dip, the braid coat method, etc., and to be especially carried out using an organic matter, by the spin coat method or the forming-membranes method using the head for ink jet recording.

[0014]Here, in order to form a metallic colloid layer with a spin coat method, oxygen plasma treatment performs parent ink(solution)-ization of a base material surface, and it carries out by using the solution containing metallic colloid as coating liquid, for example.

[0015]In order to form a metallic colloid layer by the forming-membranes method using the head for ink jet recording, For example, it carries out by printing using the head for ink jet recording by using as ink the solution which contains metallic colloid in the substrate etc. by which pattern NINGU was carried out with parent ink processing or ink-repellent treatment beforehand.

[0016]In this embodiment, since formation of a conducting film takes place in an instant by the exposure of said energy line, applying also to the metal which oxidizes easily is possible, and extensive various metal can be used. Therefore, especially as metal used for formation of said metallic colloid layer, it is not restricted, for example, silver, gold, palladium, platinum, etc. are mentioned, and silver, gold, and

palladium are preferred in respect of stability especially.
[0017]Although the thickness in particular of said metallic colloid layer is not restricted, it is usually desirable to be preferably referred to as 0.5-2 micrometers 0.1-5 micrometers.
[0018]As a substrate for forming said metallic colloid layer used for this embodiment, high polymer substrates, such as a glass substrate, poly aniline, and polyester, etc. are mentioned, for example.
[0019]Since according to the manufacturing method of this embodiment it can form from the liquid phase and removal of the organic matter by the exposure of said energy line can be performed in an instant, the metal conducting film excellent in conductivity can be obtained easily and cheaply.
[0020]The manufacturing method of the film of this invention is not limited to the desirable embodiment mentioned above, for example, as a colloid layer, It is also possible to consider it as the gestalt of the method of using semiconductor colloid layers, such as cadmium selenide, a cadmium sulfide, and titanium oxide, etc., and manufacturing the film (thin film) of the characteristic with good semiconductor membrane etc. instead of said metallic colloid layer.
[0021](Metal conducting film) The metal conducting film obtained by a manufacturing method which mentioned the film of this invention above as the desirable embodiment is mentioned. 5-1000 nm of particle diameter of the metallic colloid in which the conducting film of this embodiment constitutes it is about 200-500-nm things especially.
[0022]Especially although the thickness in particular of the conducting film of this embodiment is not restricted, it is about 0.5-2 micrometers 0.1-5 micrometers.
[0023]The conducting film of this embodiment can be used for the use of wiring, a terminal, a hydrogen storing metal alloy, etc., for example. Since it has the conductivity outstanding as above-mentioned, especially the conducting film of this embodiment can mainly be used suitably for wiring and a terminal.
[0024]The film of this invention cannot be limited to the conducting film as a desirable embodiment mentioned above, can also be made into the gestalt of other functional thin films, for example, can be used also for the use of a semiconductor device, the functional thin film in other functional devices, etc.
[0025]
[Example]Hereafter, an example explains the manufacturing method of this invention still in detail. However, this invention is not restricted at all by these examples.
[0026][Example 1] Using citrate as an organic matter, this solution and the solution of silver nitrate were mixed and dark Ag colloid solution was obtained by flowing back. This was formed by the spin coat method with drops (natural seasoning), and the silver colloid layer was formed on the glass substrate. Copper gloss was shown when the surface of the silver colloid layer at this time was observed with the microphotograph. Originally, although Ag colloid should show silver gloss, as a reason which showed copper gloss in this way, absorption of said silver colloid layer exists in a light range, and it is thought that it is because the absorption makes the origin level produced when the Ginhara child and an organic matter join together.
[0027]Next, as shown in drawing 3, it is the xenon lamp 20. ["USHIO Optical ModuleX" (the directly under exposure, the elliptic mirror) made from USHIO Electrical and electric equipment] As opposed to the sample 6 which provided the silver colloid layer on the glass substrate mentioned above using (the amount of used electricity 500W), The conducting film was manufactured in this silver colloid layer from this glass substrate by irradiating with the energy line 5 used as big absorption intensity for 60 seconds with focal light from the light source part 8 in the lamp box 7. the place which observed the situation of the surface of the silver colloid layer at this time (under an exposure) under the microscope

-- an exposure -- it discolors selectively from per 10 seconds, and discolored altogether in 60 seconds. This is considered to be one proof (it is indirect) which shows that the organic matter in a silver colloid layer has removed (the silver conducting film should be formed). The particle diameter of the silver colloid which constitutes this silver conducting film was about 300 nm.

[0028](Metallic character evaluation; reflection-spectrum measurement) About the obtained silver conducting film (after lamp radiation), when the reflection spectrum was measured, the result as shown in the reflection-spectrum figure (correlation graph of a reflectance-wave number) shown in drawing 4 was obtained. The result of the reflection-spectrum measurement about the silver colloid layer before lamp radiation is also shown in drawing 4. This reflection-spectrum figure makes aluminum a reference (reflectance =1 of aluminum). It is the method of seeing whether measurement of a reflection spectrum having a metallic thing (films, such as a conducting film and a metallic colloid layer) used as the object here. And in the case of metal, reflectance is set to 1 toward the energy 0 (wave number [of 0 cm] $^{-1}$ in drawing 4). On the other hand, in the case of an insulator (a semiconductor is included), reflectance is conversely set to 0 with the energy 0. It is suggested from these things that the film after an exposure changes metallically.

[0029](Conductive evaluation; preliminary resistance measurement) Conductivity (conductivity) was evaluated by measurement of preliminary (based on the distance between testers of 2 mm, and the tester of 2 micrometers of thickness) resistance about the obtained silver conducting film again. As a result, resistance is 3ohms and was excellent in conductivity. Incidentally, before forming this conducting film, the resistance of the silver colloid layer before an energy-line exposure is 10ohms. Thus, in the most elementary and big experimental condition of contact resistance of a tester, It is before and after an exposure, and the difference of resistance like this has come out, and it is clear also from resistance sufficiently small also as an absolute value being shown that resistance's after an exposure the conductive improved effect by the energy ray concerning this invention is very high.

[0030][Examples 2 and 3] replacing with Ag and using Pd in Example 1, using Au (example 2) (example 3) -- ** -- the golden conducting film and the palladium conducting film were formed like Example 1, respectively. When the same evaluation as Example 1 was carried out about both the obtained conducting films, the outstanding effect as Example 1 with any same conducting film was acquired.

[0031][Example 4] The silver conducting film was formed like Example 1 except having adopted the method of replacing the method of forming membranes at the time of forming a metallic colloid layer with a spin coat method, and using the usual head for ink jet recording. And when the evaluation same about this conducting film as Example 1 was carried out, the same outstanding effect as Example 1 was acquired.

[0032]

[Effect of the Invention]According to the manufacturing method of this invention, the film (thin film) of the good characteristic can be provided, and since it can form from the liquid phase and removal of the organic matter by the exposure of said energy line can be performed especially in an instant, the metal conducting film excellent in conductivity can be provided easily and cheaply.